

Remarks

Claims 1-29, 32, and 33 are now pending in this application. Claims 30 and 31 have been cancelled; claims 1-4, 6, 7, 9, 11-13, 15, 16, 18, 20, 22, and 28 have been currently amended; claims 32 and 33 have been added; and claims 1, 11, 20, and 28 are now independent claims. Because there are still 4 independent claims and 31 total claims, no additional fees are due.

In the office action, the examiner objected to claim 28 as being dependent from a rejected base claim, but stated that the claim would be allowable if rewritten in independent form, including all of the limitations of the base claim and the intervening claims. Claim 28 has been rewritten accordingly, so it is now allowable.

The examiner rejected claims 1-11, 13-20, 23-27, and 29-31 as being anticipated by Hansen et al., but the claims have been amended to overcome this rejection. The examiner mistakenly stated that Hansen et al. teaches an apparatus and a method that moves a megasonically energized interface. Actually, Hansen et al. teaches moving the workpiece or moving an unenergized interface. In fact, the megasonically energized interface *cannot* be moved in the Hansen et al. device because the process liquid then ceases to cover the transducers. This would immediately and irreparably damage the transducers.

In addition, Hansen et al. teaches in every embodiment having upper transducers that the transducers propagate megasonic energy toward the workpiece. The invention recited in these claims does not direct the megasonic energy toward the workpiece, but is substantially parallel to the workpiece. Any nonparallel propagation due to reflections within the process tank is at very oblique angles to the surface of the workpiece. This gives the invention an advantage over the Hansen et al. device—there is a significantly reduced risk of damage to the fine structure of the workpiece. This risk is so great in the Hansen

et al. device that Hansen et al. suggests operating one of the transducers at low power, or even shutting it off.

These claims now recite that the transducers are all located below the workpiece. This limitation is clearly shown in the drawings and, therefore, does not add any new matter. Hansen et al. does disclose locating a megasonic transducer in the lower portion of the process tank, but that transducer is not equivalent to the energizing transducers in the invention. The objective of the lower transducer in Hansen et al. is *not* to energize the interface. Also, Hansen et al. teaches that the boundary layer thinning due to the lower transducer is the result of acoustic streaming, rather than from the creation of a zone having sufficient intensity to remove particles from the workpiece. In fact, Hansen et al. teaches that the lower transducer should not produce the same effect as the upper transducers. Therefore, Hansen et al. does not teach having a transducer for energizing the interface with megasonic energy located below the workpiece. The lower transducer in Hansen et al. is not sufficient to energize the interface.

As for the method claims, even if the lower transducer *was* of sufficient power to energize the interface, Hansen et al. does not teach operating the lower transducer in a manner that energizes the interface. The different embodiments of Hansen et al. can be divided into two groups for determining anticipation: 1) those where the upper transducers are energized and create the zone "Z," and 2) those where the upper transducers are not energized. In the latter case, there is no need for moving the workpiece to expose the entire face of the workpiece to the zone "Z," so there are no steps corresponding to steps (C) and (D) of the claims. In the first case, Hansen et al. states that the lower transducer may remain powered on while the workpiece is moved through zone "Z." In this case, however, the lower transducer will not contribute any significant energy to the interface.

Hansen et al. may show energizing the lower transducer while filling and emptying the process tank, but this operation is insufficient to energize the

interface. Although Hansen et al. teaches use of the lower transducer for quenching, this operation is initially at low power, with the power level rising as the process liquid level rises, with the reverse occurring during the emptying of the process tank. This, along with the fact that the transducer already operates at lower power than the upper transducers, means that there is an insufficient amount of megasonic energy to energize this interface over the lower part of the workpiece. Also, the workpiece is exposed to an interface that is extremely nonuniform in terms of the amount of megasonic energy present in the interface as it sweeps across the workpiece.

Claims 30 and 31 have been cancelled. The independent claims 1, 11, and 20 have been amended to indicate that all of the transducers are located below the workpiece. Claims 2-10, 13-19, and 23-27 are all dependent, directly or indirectly, from one of these three independent claims. Hansen et al. does not show a transducer, located below the workpiece, for energizing the interface with megasonic energy. Therefore, claims 1-11, 13-20, 23-27, and 29 are now allowable over Hansen et al.

The examiner rejected claim 12 as being unpatentable over Hansen et al. Claim 12 is dependent from claim 11, and claim 11 is now allowable because it has been amended to require all of the transducers to be located below the workpiece. Because claim 12 is dependent from the allowable claim 11, it is also allowable.

The examiner rejected claims 21 and 22 as being unpatentable over Hansen et al. in view of Bergman. Claims 21 and 22 are dependent from claim 20 and require that the workpiece remain stationary during the method. Bergman does, indeed, show moving the level of the process liquid across the workpiece. There is, however, no suggestion that the method shown in Bergman should be used in combination with the method shown in Hansen et al. Moving the interface would cause the interface to fall below the transducers in the Hansen et al. device. Doing that would cause the transfer of megasonic energy from the

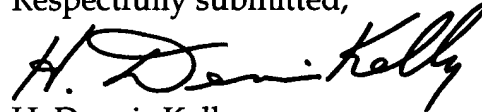
transducers to the liquid to cease, and the transducers would almost immediately overheat and be destroyed. The interface cannot be moved unless all of the transducers are located below the level of the workpiece, as recited in the claims. There is no suggestion in either Hansen et al. or Bergman that all of the transducers be located below the workpiece. Therefore, claims 21 and 22 are now allowable over the combination of Hansen et al. and Bergman.

A few other amendments have been made that should be noted. Claim 22 has been amended to remove a term that lacked an antecedent basis. This claim now recites "repetitions of step (C)" rather than "successive sweeps." No new subject matter is introduced by this amendment.

Claim 18 has also been amended to add a limitation. The means for using megasonic energy to propel entrained particles from the process liquid into the overflow liquid now is limited to occur while the interface is located above the workpiece. In Hansen et al. all overflow occurs while the interface is in contact with the workpiece. Claim 18 now requires the overflow to occur above the workpiece. This method has the advantage of being cleaner than the method shown in Hansen et al. No new matter is introduced by this amendment.

Applicant respectfully requests that the claims be allowed and that a notice of allowance be issued on this application.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "H. Dennis Kelly", written in a cursive style.

H. Dennis Kelly

Attorney for Applicant

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